



# Motion-Robust Cardiac B<sub>1</sub><sup>+</sup> Mapping of the Transmit Field

**IP Status:** Issued US Patent; **Application #:** 15/697,184

## Robust Transmit Field Quantification Around the Heart

A novel imaging sequence offers motion-robust quantification of the transmit field amplitude (B<sub>1</sub><sup>+</sup> mapping) in magnetic resonance imaging (MRI). The technique acquires images with two off-resonance shifts, using an interleaved Bloch-Siegert scheme along with an off-resonance insensitive B<sub>1</sub><sup>+</sup> sensitization to allow for motion-robust quantification of the RF transmit field for cardiac scans in a short scan time. It obtains reproducible and stable image quality, even if the scan is performed during free-breathing, and allows robust assessment of the flip-angle variation (observed to be up to 50% across the heart in conventional cardiac MRI scans at 3T). In addition, this technique can enable robust transmit field quantification around the heart used with commercially available MRI scanners. No additional hardware is needed, and regular vendor software or sequence update routines can distribute any upgrades.

## Improved MRI Quantification, Shimming and Flip-angle Correction

Transmit field mapping is required for high image quality at ultra-high fields, and is important for accurately quantifying various MRI parameters. However, this task is particularly challenging with moving tissues, such as the heart. Previously proposed methods for quantitative mapping of the RF transmit field around the heart offer insufficient motion resilience, thus severely limiting their quality and robustness. Furthermore, variations of the RF transmit field (B<sub>1</sub><sup>+</sup>) in MRI may cause substantial differences in the effective flip-angle, which needs to be exact for accurate tissue quantification and B<sub>1</sub><sup>+</sup> shimming. This imaging sequence acquires the images with two off-resonance shifts (10 k-space lines at a time) that produce a significantly clearer image for moving tissue, offering improved quantification, shimming and flip-angle correction. In addition, it enables imaging of the heart on 1.5T+ MRI machines and enables imaging of the heart with free breathing.

### BENEFITS AND FEATURES:

- Heart imaging with free breathing
- Motion-robust quantification
- Cardiac B<sub>1</sub><sup>+</sup> mapping of transmit field
- Bloch-Siegert technique
- Used with commercially available MRI scanners
- Improved quantification, shimming and flip-angle correction
- Enables imaging of the heart on 1.5T+ MRI machines

### APPLICATIONS:

- Quantitative MRI, quantitative evaluation of cardiomyopathies and/or quantitative assessment of moving organs
- Ultra-High-Field (UHF) imaging
- Qualitative MRI of the heart
- Conventional MRI scanners

### Technology ID

20170032

### Category

Engineering & Physical Sciences/MRI & Spectroscopy  
Life Sciences/Diagnostics & Imaging  
Life Sciences/Human Health  
Life Sciences/MRI & Spectroscopy  
Agriculture & Veterinary/Veterinary Medicine

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**Phase of Development** - In vivo

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[External Link](#) (ece.umn.edu)

**Publications**

[Motion-Robust Cardiac B1+ Mapping at 3T Using Interleaved Bloch-Siegert Shifts](#)

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